



# STGW12NB60HD

N-CHANNEL 12A - 600V TO-247  
PowerMESH™ IGBT

PRELIMINARY DATA

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGW12NB60HD	600 V	< 2.8 V	30 A

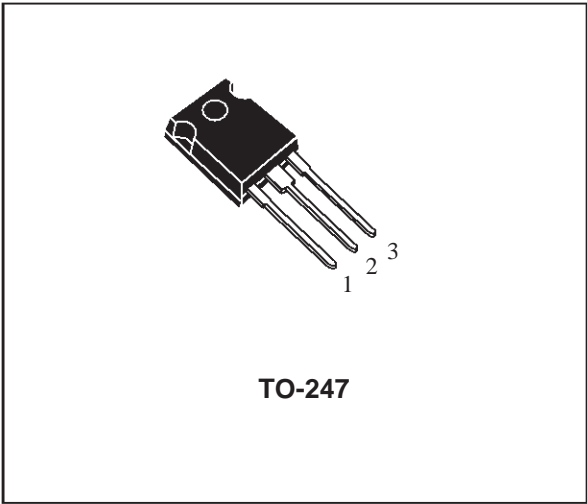
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>CESAT</sub>)
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- OFF LOSSES INCLUDE TAIL CURRENT
- CO-PACKAGED WITH TURBOSWITCH™ ANTIPARALLEL DIODE

DESCRIPTION

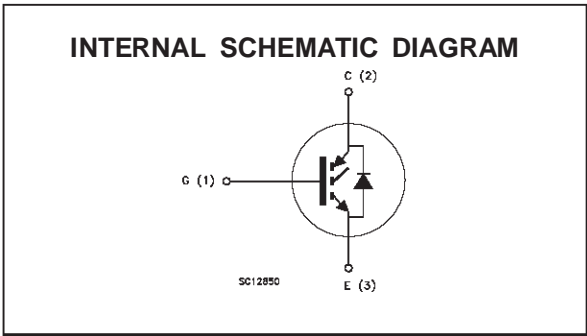
Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "H" identifies a family optimized to achieve very low switching times for high frequency applications (<120kHz).

APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- SMPS AND PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES
- UPS



TO-247



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	600	V
V <sub>GE</sub>	Gate-Emitter Voltage	± 20	V
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 25 °C	24	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 100 °C	12	A
I <sub>CM</sub> (•)	Collector Current (pulsed)	96	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	120	W
	Derating Factor	0.96	W/°C
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C
T <sub>j</sub>	Max. Operating Junction Temperature	150	°C

(•) Pulse width limited by safe operating area

## STGW12NB60HD

### THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.04	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	30	$^{\circ}C/W$
$R_{thc-h}$	Thermal Resistance Case-heatsink	Typ	0.1	$^{\circ}C/W$

### ELECTRICAL CHARACTERISTICS ( $T_j = 25^{\circ}C$ unless otherwise specified)

#### OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CE)}$	Collector-Emitter Breakdown Voltage	$I_C = 250 \mu A$ $V_{GE} = 0$	600			V
$I_{CES}$	Collector cut-off ( $V_{GE} = 0$ )	$V_{CE} = \text{Max Rating}$ $T_j = 25^{\circ}C$ $V_{CE} = \text{Max Rating}$ $T_j = 125^{\circ}C$			250 2000	$\mu A$ $\mu A$
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20 V$ $V_{CE} = 0$			$\pm 100$	nA

#### ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}$ $I_C = 250 \mu A$	3		5	V
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15 V$ $I_C = 12 A$ $V_{GE} = 15 V$ $I_C = 12 A$ $T_j = 125^{\circ}C$		2 1.7	2.8	V V

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 25 V$ $I_C = 12 A$		9.5		S
$C_{ies}$ $C_{oes}$ $C_{res}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25 V$ $f = 1 MHz$ $V_{GE} = 0$		920 120 27		pF pF pF
$Q_G$ $Q_{GE}$ $Q_{GC}$	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 480 V$ $I_C = 12 A$ $V_{GE} = 15 V$		68 10 30		nC nC nC
$I_{CL}$	Latching Current	$V_{clamp} = 480 V$ $R_G = 10 \Omega$ $T_j = 150^{\circ}C$	48			A

### SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Delay Time Rise Time	$V_{CC} = 480 V$ $I_C = 12 A$ $V_{GE} = 15 V$ $R_G = 10 \Omega$		5 46		ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{CC} = 480 V$ $I_C = 12 A$ $R_G = 10 \Omega$ $V_{GE} = 15 V$		800		A/ $\mu s$
$E_{on(\circ)}$	Turn-on Switching Losses	$T_j = 125^{\circ}C$		290		$\mu J$

**ELECTRICAL CHARACTERISTICS** (continued)**SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$ $I_C = 12\text{ A}$		150		ns
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 10\ \Omega$ $V_{GE} = 15\text{ V}$		27		ns
$t_d(off)$	Delay Time			76		ns
$t_f$	Fall Time			92		ns
$E_{off}(^{**})$	Turn-off Switching Loss			0.21		mJ
$E_{ts}(^{\circ})$	Total Switching Loss			0.49		mJ
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$ $I_C = 12\text{ A}$		229		ns
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 10\ \Omega$ $V_{GE} = 15\text{ V}$		76		ns
$t_d(off)$	Delay Time	$T_j = 125\text{ }^{\circ}\text{C}$		95		ns
$t_f$	Fall Time			200		ns
$E_{off}(^{**})$	Turn-off Switching Loss			0.45		mJ
$E_{ts}(^{\circ})$	Total Switching Loss			0.74		mJ

**COLLECTOR-EMITTER DIODE**

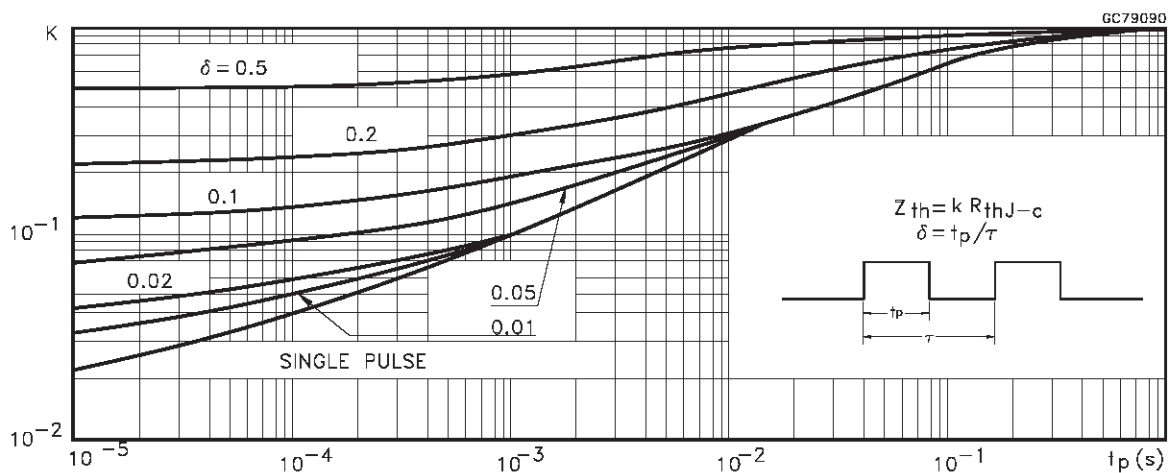
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$	Forward Current				12	A
$I_{fm}$	Forward Current pulsed				96	A
$V_f$	Forward On-Voltage	$I_f = 12\text{ A}$		1.55	2.0	V
		$I_f = 12\text{ A}$ $T_j = 125\text{ }^{\circ}\text{C}$		1.3		V
$t_{rr}$	Reverse Recovery Time	$I_f = 12\text{ A}$ $V_{clamp} = 200\text{ V}$		100		nS
$Q_{rr}$	Reverse Recovery Charge	$di/dt = 100\text{ A}/\mu\text{S}$ $T_j = 125\text{ }^{\circ}\text{C}$		330		nC
$I_{rrm}$	Reverse Recovery Current			6.3		A

(●) Pulse width limited by max. junction temperature

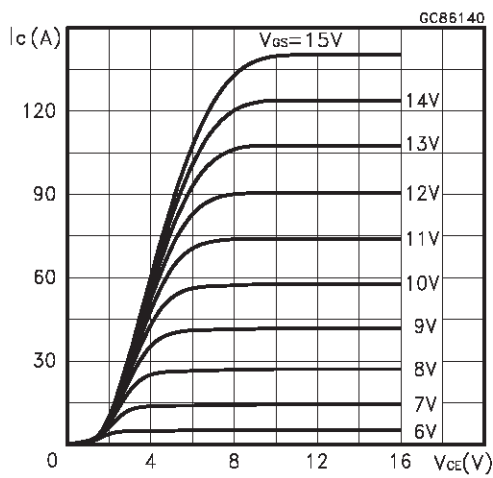
( $\circ$ ) Include recovery losses on the STTA1206 freewheeling diode

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

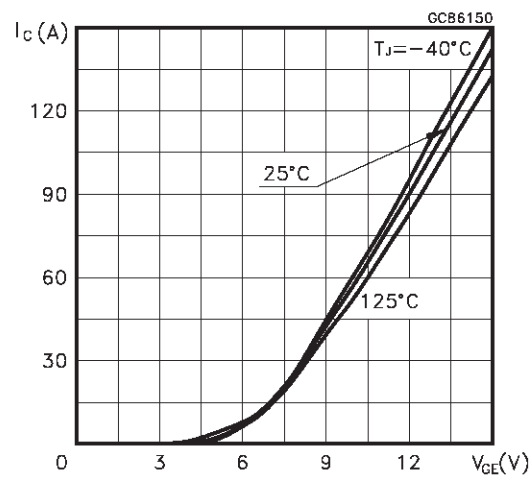
(\*\*) Losses Include Also The Tail (Jedec Standardization)

**Thermal Impedance**

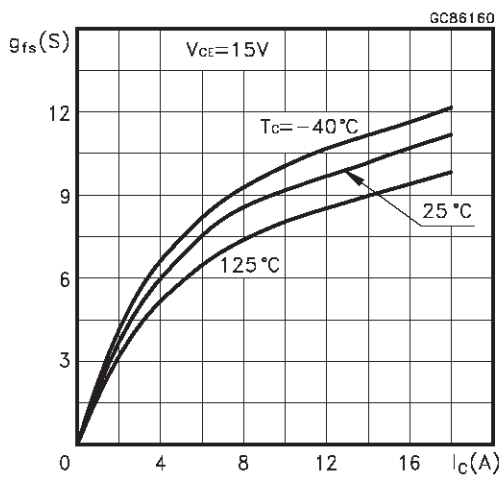
Output Characteristics



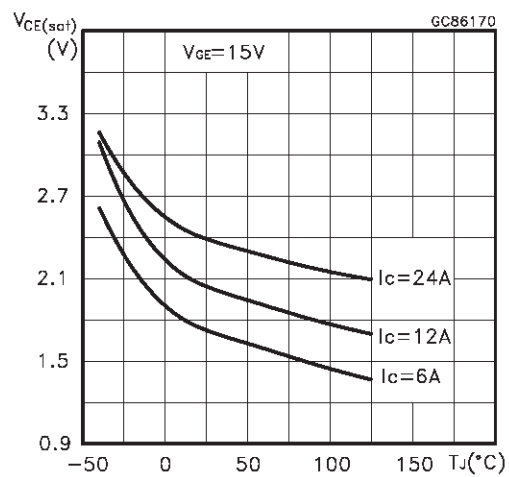
Transfer Characteristics



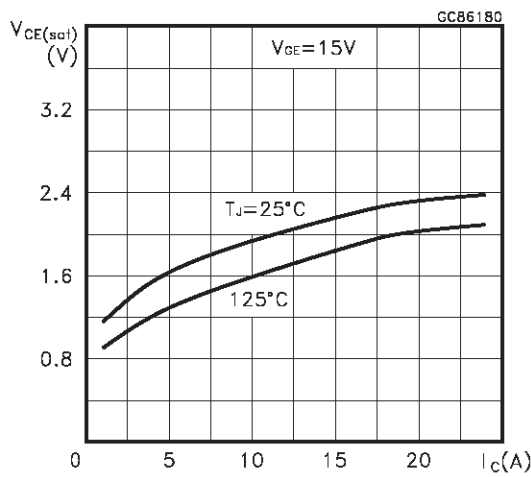
Transconductance



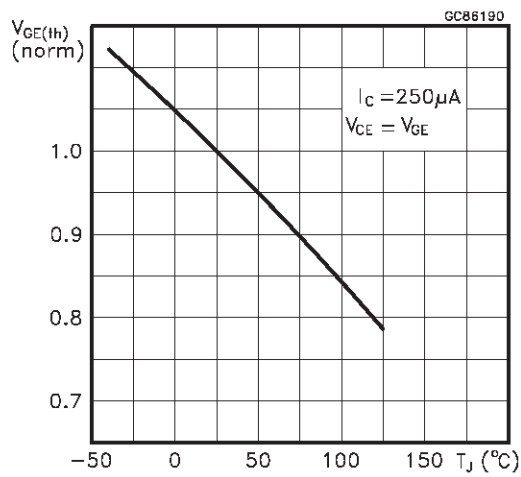
Collector-Emitter On Voltage vs Temperature



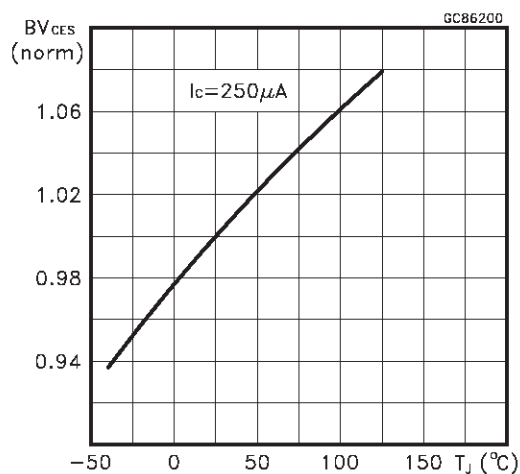
Collector-Emitter On Voltage vs Collector Current



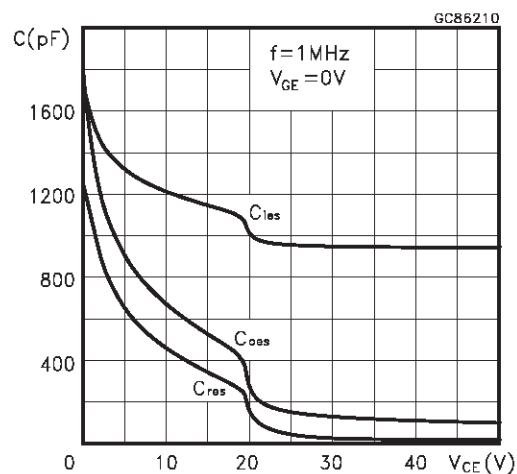
Gate Threshold vs Temperature



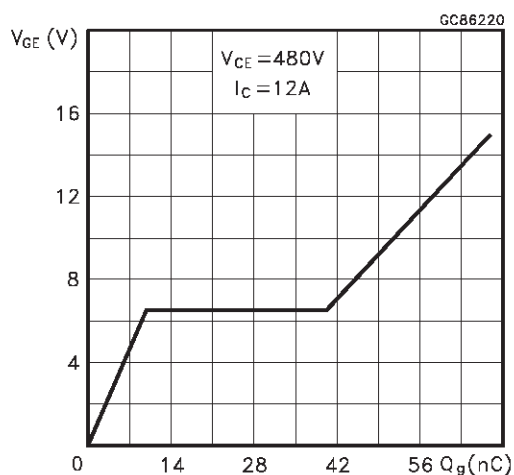
Normalized Breakdown Voltage vs Temperature



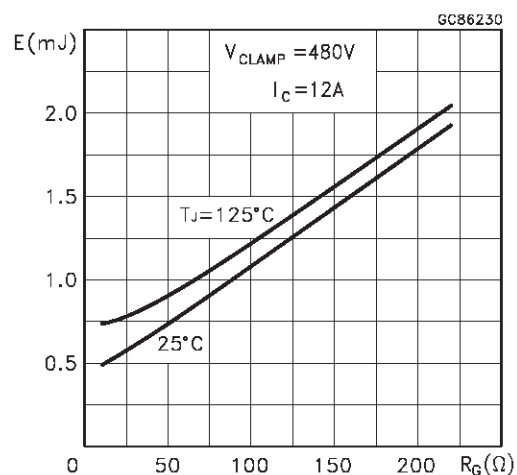
Capacitance Variations



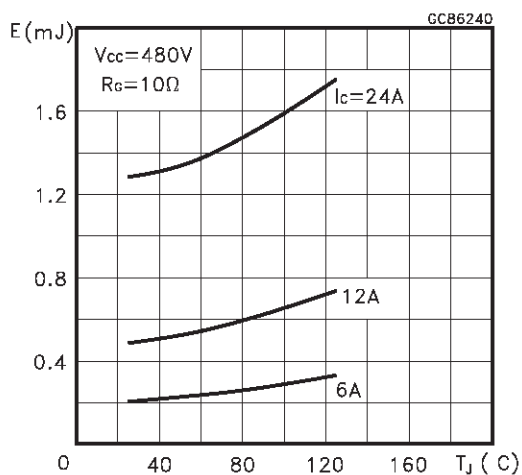
Gate Charge vs Gate-Emitter Voltage



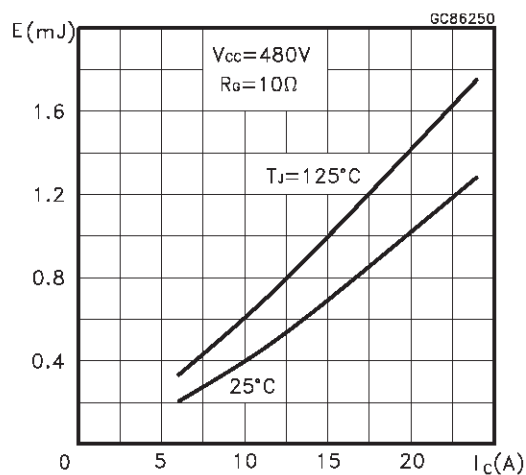
Total Switching Losses vs Gate Resistance



Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



Switching Off Safe Operating Area

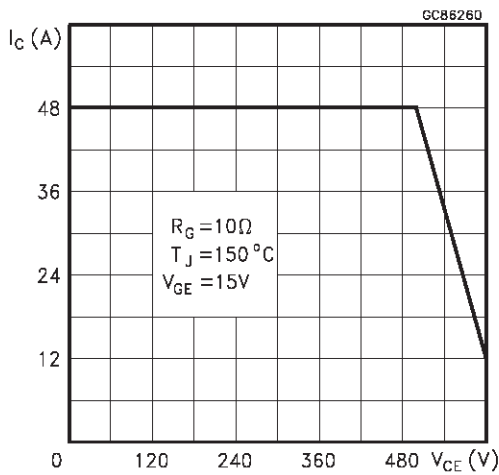


Fig. 1: Gate Charge test Circuit

Diode Forward Voltage

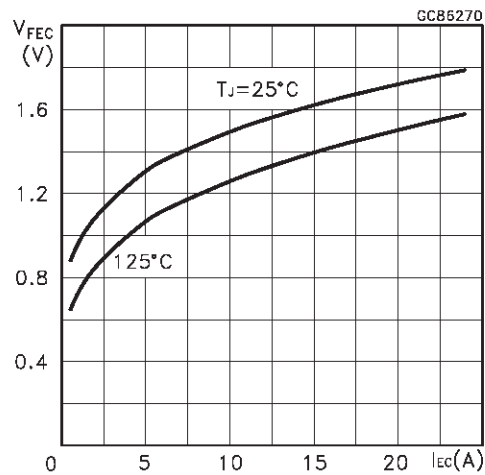


Fig. 2: Test Circuit For Inductive Load Switching

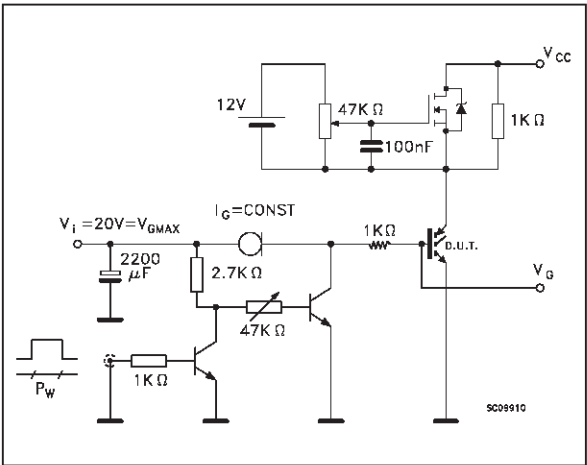
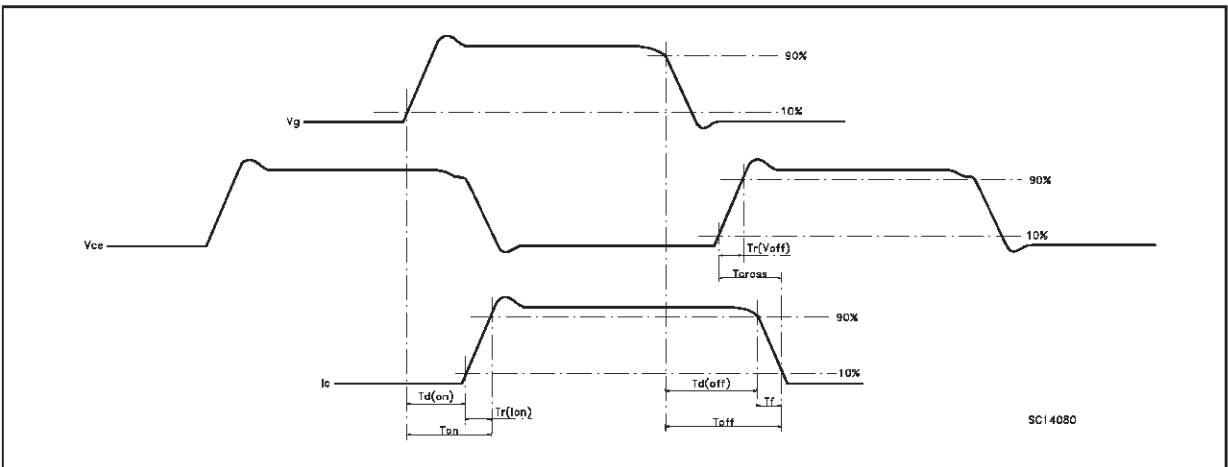
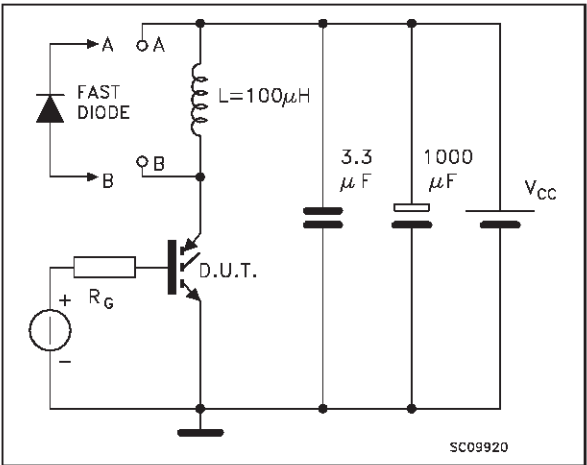
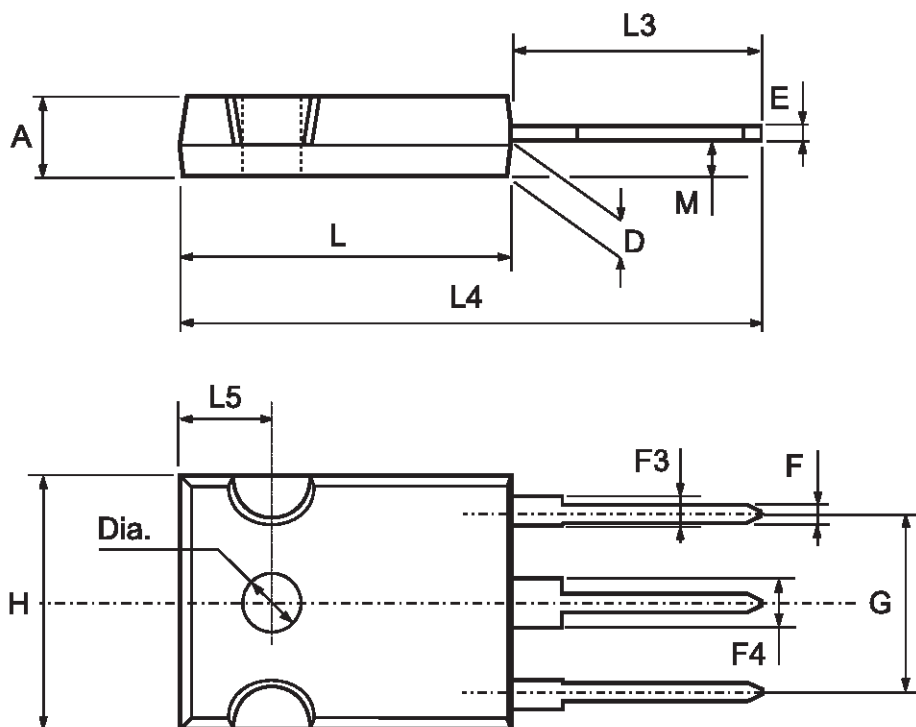


Fig. 3: Switching Waveforms



## TO-247 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.7		5.3	0.185		0.209
D	2.2		2.6	0.087		0.102
E	0.4		0.8	0.016		0.031
F	1		1.4	0.039		0.055
F3	2		2.4	0.079		0.094
F4	3		3.4	0.118		0.134
G		10.9			0.429	
H	15.3		15.9	0.602		0.626
L	19.7		20.3	0.776		0.779
L3	14.2		14.8	0.559		0.582
L4		34.6			1.362	
L5		5.5			0.217	
M	2		3	0.079		0.118



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